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# IMPLEMENTATION COMPLETION REPORT

## REPUBLIC OF KOREA

## JUAM REGIONAL WATER SUPPLY PROJECT
(LOAN 3178-KR)

June 28, 1996

Infrastructure Operations Division
Country Department I
East Asia and Pacific Region

## CURRENCY EQUIVALENTS

Currency Unit - Won (W)

Average used in appraisal estimates (September 1989): US$ = W 660

Actual yearly average market values:

US$ = w 671 1989
US$ = w 708 1990
US$ = w 720 1991
US$ = w 780 1992
US$ = w 802 1993
US$ = w 803 1994
US$ = w 770 1995

## WEIGHTS AND MEASURES

| | |
|---|---|
| 1 meter (m) | = 39.37 inches |
| 1 kilometer (km) | = 1,000 meters or 0.62 mile |
| 1 square meter (m2) | = 10.8 square feet |
| 1 square kilometer (km2) | = 0.38 square mile |
| 1 hectare (ha) | = 10,000 square meters or 2.47 acres |
| 1 cubic meter (m3) | = 1,000 liters or 264 US gallons |
| 1 liter (l) | = 0.26 US gallon |
| 1 liter per capita per day (lcd) | = 0.26 US gallons per capita per day |
| 1 metric ton (t) | = 1,000 kilograms or 2,205 pounds |

## GOVERNMENT FISCAL YEAR

January 1 to December 31

## ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| ERR | - | Economic Rate of Return |
| JRWSS | - | Juam Regional Water Supply System |
| KMA | - | Kwangju Metropolitan Area |
| KOWACO | - | Korea Water Resources Corporation |
| KWA | - | Kwangju Water Agency |
| MOCT | - | Ministry of Construction and Transportation |
| MOFE | - | Ministry of Finance and Economy |
| MOHA | - | Ministry of Home Affairs |
| NWIP | - | National Water Improvement Program |
| NRW | - | Non-Revenue Water |

IMPLEMENTATION COMPLETION REPORT

REPUBLIC OF KOREA

JUAM REGIONAL WATER SUPPLY PROJECT
(LOAN 3178-KO)

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## Preface

This is the Implementation Completion Report (ICR) for the Juam Regional Water Supply Project in the Republic of Korea, for which Loan 3178-KO in the amount of US$ 34 million equivalent was approved on March 20, 1990 and made effective on December 4, 1990. The loan was reduced by a cancellation of US$ 1.7 million in October 1993 from savings made on equipment and supplies.

The loan was closed on December 31, 1994. The final transaction took place on August 2, 1995, at which time a balance of US$ 4.3 million equivalent was canceled.

The ICR was prepared by the Infrastructure Operations Division, Country Department 1, East Asia and Pacific Region, and reviewed by Mr. Shivakumar, Chief, Infrastructure Operations Division, EA1, and Mr. Schwermer, Project Advisor, EA1.

Preparation of this ICR began during the Bank's completion mission in November 1995. It is based on material in the project file. The borrower contributed to preparation of the ICR by preparing its own evaluation of the project's execution and initial preparation which is attached in Appendix A. The borrower also commented on the draft ICR.

# IMPLEMENTATION COMPLETION REPORT
# KOREA
# JUAM REGIONAL WATER SUPPLY PROJECT
# (LOAN 3178-KO)

## Evaluation Summary

### A. Introduction

(i) The Juam Regional Water Supply Project was designed to increase the water supply in for the Kwangju Metropolitan Area (KMA), a low-income region in southwestern Korea. the KMA includes Kwangju City and eight other neighboring municipalities. Before the project, the KMA was suffering from serious water shortage problems that were hampering development. Kwangju City was about to begin water rationing in 1990, and access to public water supply in the other municipalities was either non-existent or rationed. The project was designed to provide water to the KMA from the already constructed (1991) Juam Dam. A brief description of the Juam Regional Water Supply System appears in Appendix B.

### B. Project Objectives

(ii) The objectives of the project were to: (a) support the development of one of the least developed regions in Korea; (b) improve and expand water supply to about 96% of the population in KMA by 2001 and thus serve most of the region's low-income population; (c) ensure efficient use of scarce water resources; (d) strengthen KWA's and KOWACO's planning capacity and finances; and (e) support institutional improvements in the sector. These objectives were consistent with the Korean sectoral objectives, supported by the Bank, of increased focus on social lending, environmental improvement, and institutional development by transfer of technology. It should be noted that the timing of the objective of expanding water supply to 96% of the population (by 2001) was somewhat outside the timeframe of the project, but is nonetheless a reasonable objective, which is well on the way to being met.

(iii) To expand the water supply made available under this project, it was necessary for Kwangju City and the eight adjacent municipalities to construct, with their own funds and local loans, complementary works, including a water treatment plant (WTP) in Kwangju and distribution systems in KMA and the municipalities, not later than December 1993.

(iv) The project's covenants provided a framework for financial discipline, and supported the objectives of achieving and maintaining satisfactory performance, consistent with appropriate national economic and social objectives. This, in turn, supported the objectives of improving institutional capacity and strengthening KWA's and KOWACO's planning capacity and financial picture. Both KOWACO and KWA were required to set tariffs yielding adequate revenues to meet operation and maintenance costs including depreciation, administrative expenses, and providing rates of return on net revalued fixed assets in operation.

(v) To further develop institutional capacity, KWA's manually prepared planning and budgeting systems needed to be modernized and, in addition, a management information system was to be introduced with monthly water demand, income and expenditure, which were to be sent to the Bank every six months.

### C. Implementation Experience and Results

(vi) The project was well prepared. The planning was sound and the results would suggest that the project was well founded, and the agreements reached to promote realization of the objectives were realistic and well conceived. The physical objectives were achieved and the project benefits are sustainable with clear support of the government and the management, and the proficiency of KOWACO which will operate the system. The institutional objectives were partially achieved. While non-revenue water control efforts were successful, tariffs did not keep pace with legal covenants. While water pricing was not fully satisfactory, however, this did not interfere in achieving the important objective of maintaining effective and efficient operations and maintenance as funds for these purposes were provided from other sources. Overall, the performance of the project was satisfactory.

(vii) The project delivered the water supply in the volumes anticipated, although a two year delay in completion of the project resulted from insufficient national budget allocations. The quality of the works was high. Leakage was experienced in the project tunnels due to an operational accident while testing completed works, which led to damage to adjacent farm land. Repair work to correct the leaks was completed at the end of 1995.

(viii) The complementary works in KMA and the other municipalities have been completed to a satisfactory standard, and have resulted in water demand being met in Kwangju City after many years of shortages. The project was modified so that Mokpo town could be supplied from an extension of the raw water pipeline supplying Kwangju City. The resulting reduced supply to Kwangju City will be made up from additional water from the second stage of the Juam scheme, presently scheduled for completion in 1998.

(ix) The estimated project cost at appraisal was US$ 183.0 million, of which US$ 34.0 million equivalent was to be financed by the Bank, with the balance from government contributions. The actual cost of the project, including interest during construction, was US$ 150.3 million, not including US$ 61.3 million for the Mokpo extension. In 1993, the Bank loan was reduced by a cancellation of US$ 1.7 million equivalent from savings made on equipment and supplies, and US$ 4.3 million equivalent was canceled when the loan was closed on December 31, 1994. Thus, the net loan amount was US$ 28.0 million equivalent. The economic rate of return expected at appraisal was 8.0 percent. The recalculation using the financial rate of return as a measure and based on actual data including the extension to Mokpo is 7.0 percent, which is adequate considering the social nature of the project.

(x) KOWACO operates a uniform water tariff policy, and any increase in its tariffs has a knock-on effect on over half the water companies in Korea. Due to Government's anti-inflation politics in the early 1990s, it was decided to scale down the increases in KOWACO's tariffs, and any shortage of resources for operations and maintenance of the corporation's facilities would be made up from funds generated form the sale of the corporation's land developments. Due to the delay in raising water tariffs, KOWACO and KWA did not attain financial self-sufficiency as envisaged during appraisal, but both agencies received adequate funds from other sources to efficiently manage and operate their facilities, thus meeting a major financial objective.

(xi) While it was intended that KOWACO's would be responsible, beginning in 1990, for financing construction of all dams and regional water supply systems from its own resources, future self-sufficiency is still planned. The current plan is that KOWACO will contribute 30% to

development from 1996, and tariffs levels would be increased in steps to achieve the required level by 1999, by which time it would meet its 5% rate of return target. Nonetheless, since KOWACO failed to meet the agreed rate or return covenant and to provide an acceptable action plan to correct the situation, the last request for extension of the loan closing date was not accepted by the Bank.

**D. Summary of Findings, Future Operations, and Key Lessons Learned**

(xii) The project was completed after a two year delay, with a modification to supply Mokpo town with raw water from the Kwangju pipeline. The actual project cost without Mokpo modification was 18% less than projected during appraisal, and with the modification was 16% above the projection

(xiii) The completed works will be operated and maintained by KOWACO, and the complementary works by KWA and the municipalities. All these agencies are experienced in operating similar systems, and have satisfactory management and staff in sufficient numbers to carry out the work. Financial performance is expected to be satisfactory.

(xiv) The main lessons to be drawn from the experience of implementation of the project are:

(a) training of KWA staff on the new facilities needs to be improved and guided by specialists in latest technology;

(b) the importance of setting adequate tariffs has to be understood by all involved agencies to ensure timely funding of development projects;

(c) the means of achieving the targets set in financial covenants to generate adequate revenues can depend on national fiscal policies outside the control of the borrower. In these cases, assurances should be received that adequate funds for the operation of facilities are made available

IMPLEMENTATION COMPLETION REPORT
KOREA
JUAM REGIONAL WATER SUPPLY PROJECT
(LOAN 3178-KO)

## PART I: PROJECT IMPLEMENTATION ASSESSMENT

### A. Introduction

1. Bank lending during the past few years in Korea has focused on sectoral lending, particularly for social sectors, environmental improvement, institutional development, and transfer of technology. In line with the Bank's strategy, the Juam Regional Water Supply Project supported the development of one of the country's least-developed regions, with emphasis on expanding services to the low income section of the urban population. The Bank's continued involvement has been instrumental in helping the government to develop a well-conceived institutional framework and policies in the sector.

2. The Korea Water Resources Corporation (KOWACO) is a public enterprise under the Ministry of Construction and Transportation (MOCT) founded for the principal purpose of improving public welfare through water supply and water quality improvement. Its major activities include construction, operation and maintenance of multi-purpose dams, estuary barrages, and development of long-distance water supply systems. KOWACO operates around half of the water systems in Korea.

3. In 1988, the Government streamlined the responsibilities of several public corporations and re-established KOWACO as the main agency responsible for water resources and bulk water supply, while centralizing land developments with the Korea Land Development Corporation. KOWACO held several large land developments and the sale of these assets over the following few years would provide substantial revenues for improvement of water resources. It was also planned that from 1990, KOWACO would have the responsibility for future construction and financing of all dams and regional water supply systems. All previous and on-going capital projects had been financed by the central government, and the assets transferred to KOWACO as an equity contribution.

4. The National Water Improvement Program (NWIP) approved in 1989, formulated a policy to ensure good quality water was available to the population, and to improve the efficiency of the sector. Under the program, municipal Water Bureaus would gradually be replaced by Water Agencies equipped with all the advantages of corporation status. In Kwangju, the change to Kwangju Water Agency (KWA) took place in 1990.

### B. Project Objectives

5. During the 1960s, government investment was concentrated on developing the country's industrial base. Since that time progressively higher priority has been given to social investments, including those for water supply and sewerage. This initiative increased the availability of a piped water supply and resulted in the generally improved health of the population.

6. As a continuation of this investment strategy, in November 1988 the government requested Bank assistance to finance the project to supply water from the Juam multi-purpose dam to KMA and eight neighboring municipalities. The objectives of the project were to (a) support the development of one of the least developed regions in Korea, (b) expand the water supply to about 96% of the population in KMA by 2001 and thus serve most of the region's low-income population, (c) ensure efficient use of scarce water resources; (d) strengthen the KOWACO and Kwangju Water Agency's (KWA) planning capacity and finances; and (e) support institutional improvements in the sector.

7. The objectives were well defined, realistic and important for the sector development, and had the commitment of the government, KOWACO, Kwangju City, the provincial government, and adjacent municipalities.

8. The project is the first stage of the Juam Regional Water Supply System (summarized in Appendix B), and was implemented by the Ministry of Construction and Transportation (MOCT) and operated and maintained by KOWACO. The complementary facilities in KMA were implemented by KWA and the works in the eight municipalities by provincial government and municipal Councils.

9. The complexity of the project was well within the capabilities of the management of MOCT, KOWACO, KWA and the provincial government. There were no unusual risks, although there could have been a risk if there had been a delay in the construction of the water treatment plant (WTP) and distribution system in Kwangju City and similar facilities in the other municipalities. However, as water supply was of great concern to the government, precedence was given to this element by the concerned ministries.

10. In a modification to the project, a feasibility study prepared in 1991 recommended the extension of the Juam raw water pipeline so that the town of Mokpo (population 240,000) could be supplied with 90,000 m3/d from the raw water pipeline supplying Kwangju City. The reduction in supply to KMA would be offset by additional water from the Juam Regional Water Supply System (JRWSS) second stage, detailed designs of which were completed in September 1994, and construction of which is scheduled for completion in 1998.

## C. Achievement of Project Objectives

11. The project was timely and well prepared, the scope and scale well thought out, and accurately represented in the SAR. The project concept was clear and shared by all relevant parties, and the design was carried out by consultants in close collaboration with all involved agencies.

Physical Objectives

12. The design of all the project components represented the least-cost solution for the water requirements of Kwangju City and eight neighboring municipalities, and several components included in the first stage were built for the final capacity. All the physical components were completed by December 31, 1995, which represented a delay of two years from the original schedule, mainly due to insufficient budgetary allocation through MOCT. Test operations commenced on November 1, 1995, and were completed by February 29, 1996.

13. In February 1995, the pipeline to Yongjon WTP in Kwangju was closed by KWA staff without first notifying KOWACO, and this caused a leakage accident in four of the nine tunnels, with some resulting damage to adjacent farm areas. New operating procedures have been introduced to ensure this type of accident does not happen again. There were also leaks in the other tunnels constructed under the project, but repair work to all the tunnels was completed in December 1995.

14. The project supplied 220,000 m3/d from July 1, 1994 and increased the proportion of the Kwangju City's population served from 74% to 95%, and per capita consumption from 260 lcd to 380 lcd. The neighboring municipalities including Mokpo, Naju and Hwasun were supplied with 165,000 m3/d from the end of 1995, and a further 255,000 m3/d will be available from the JRWSS second stage in 1997/98 out of which KWA will receive an additional 220,000 m3/d.

15. The estimated cost of the project at appraisal was US$ 183.0 million out of which US$ 34.0 million was to be financed by the Bank. The actual cost including interest during construction was US$ 211.6 million. The project cost without the addition of the Mokpo extension was US$ 150.3 million, 18 percent less than expected at appraisal. The project was financed by the government contributions and the reduced Bank loan of US$ 28.0 million after cancellation of US$ 1.7 million in 1993 from savings made on equipment and supplies, and US$ 4.3 million was canceled when the loan closed on December 31, 1994.

Financial Objectives

16. The financial objectives were established so that KOWACO's Water Division revenues would be sufficient to cover its operational and maintenance expenditure, debt servicing requirements, increasing internal cash generation and to accumulate cash reserves for future projects. KOWACO's Dams Division revenues should be sufficient to meet its operational and debt servicing requirements, and to generate internal cash to make contributions to its large investment program. KWA's financial objectives were set to cover operational and maintenance costs, servicing of debts, and to provide appropriate internal contribution to investment.

17. To achieve these objectives and protect the financial status of the agencies, tariff increases were considered necessary to ensure appropriate pricing and provide an incentive to consumers to avoid wastage and to the municipalities to reduce leakage. Based on the above considerations, rate of return targets on fully revalued assets were agreed for both agencies.

18. The post project evaluation shows that KOWACO's Water Division failed to achieve the rate of return targets set in the Project Agreement between 1991 and 1995, while the Dams Division only reached the target in 1993. In most years during implementation, KOWACO's Water and Dams Divisions did not reach the projected revenue amounts (actual results were 16% lower than expected at appraisal), due not only to inadequate tariff levels, but also to reduced electricity and water sales caused by lower than normal rainfall in some years.

19. The reduced revenues did not affect expenditure on operation and maintenance, and all debt servicing obligations have been met. The additional funds necessary to support KOWACO's operations during the years when there were no tariff increases mainly came from the sale of land developments to the Korea Land Development Corporation.

20. The financial performance of KWA was less than satisfactory as it failed to achieve the rate of return targets between 1991 and 1995. Revenues over the past three years are 16% below projections made during appraisal due to the fact that water tariff levels were not increased to the required level, and water shortages were experienced through to July 1994. This was somewhat offset by substantial improvement in the reduction of non-revenue water from 48.6% in 1990 to 31.0% in 1995. During the implementation period the Kwangju City's general account supported KWA to ensure adequate funding for operations and maintenance.

21. The actual rate of returns achieved compared to the rates in the KOWACO and KWA Project Agreements, are shown in Table 2.

Table 2: Rates of Return

| Year | KOWACO Water Div | | KOWACO Dams Div | | Kwangju Water Agency | |
|---|---|---|---|---|---|---|
| | Required | Actual | Required | Actual | Required | Actual |
| 1991 | 3.5% | 2.6% | 5.0% | 5.0% | 9.0% | 6.6% |
| 1992 | 5.0% | 2.4% | 5.0% | 2.0% | 9.0% | 8.5% |
| 1993 | 5.0% | 2.6% | 5.0% | 6.1% | 9.0% | 7.1% |
| 1994 | 5.0% | 2.1% | 5.0% | 3.3% | 9.0% | 7.5% |
| 1995 | 5.0% | 2.2% | 5.0% | 3.5% | 9.0% | 8.0% |

22. Economic rate of return expected from the project, including the Juam second stage, using the financial rate of return (FRR) as a measure, was 8.0%. The recalculation of the FRR based on actual data is not a direct comparison to the calculation made at appraisal, as it covers only the first stage of JRWSS, because reliable information required to include the second stage is not available. The recalculated FRR for the project including the extension to Mokpo is 7.0%, which is adequate considering the social nature of the project. The calculation appears in Table 9 of Part II of this report.

23. A summary of pertinent operational and financial data from KOWACO's and KWA's financial statements is in Table 6 of Part II of this report.

Tariffs

24. Due to national anti-inflationary policies, the increases in tariffs envisaged at the time of project appraisal did not take place at the required levels. Requests for tariff increases for KOWACO have to be approved by MOCT and the Ministry of Finance and Economy (MOFE). The city government in Kwangju has held the powers to approve tariff increases for KWA since 1993, but is still subject to national anti-inflationary policies.

25. KOWACO had no tariff increases in 1990, 1993 or 1994, and the increases that were approved in 1991 and 1992 were not sufficient to compensate for years when there were no increases. The reduced revenues did not adversely affect KOWACO's operations as operational costs were well controlled and most of the shortfall of income was made up from sale of land developments.

26. The situation was similar for KWA which had no increases in 1990 or 1993. The Kwangju City government made adequate subsidy contributions from its general account to cover the reduction of operational revenues from the failure to increase tariffs.

Institutional development

27. In Kwangju, the targets set to increase the efficiency of the distribution network and reduce water leakage, were exceeded. Actual NRW in 1995 was down to 31.0% from 34.9% projected during appraisal.

28. The objective for KWA to produce computerized planning and financial forecasting, as well as management information, was not completed in the form expected under the project agreement, as it was set out in an unfamiliar format. An amended reporting structure proposed by the Bank was accepted by KWA and introduced during project implementation. However, the city regularly submitted its Five Year Plans which included a section on KWA's projections, which were considered adequate by the agency. One of the main reasons for the financial forecasting reports is so that the agency can prepare information to support the necessity for tariff increases. This work was carried out by KWA finance staff, and annual submissions were regularly prepared for review by the city government.

Sector policies

29. The project has not deviated from the sector policies of the government, and the completed project conforms with the approved detailed designs.

Environmental conditions

30. The availability of reliable, adequate and safe water supplies in the municipalities served under the project has contributed to the health and well-being of the local population. In Kwangju City and the neighboring municipalities of Naju and Hwasun, sewerage systems and treatment plants are being expanded, especially for the additional water supplied under the project. In smaller municipalities, septic tanks and other sanitation systems are being upgraded.

31. The quality of water in the newly constructed Juam reservoir is of major importance as it is the source of water for a total population of around four million (Kwangju City and the other project municipalities represent about half of this total). To ensure the water quality is maintained to an acceptable standard, it was necessary to introduce controls and make investments in various pollution control measures in the water source areas and around the dam. The Juam Dam Water Pollution program includes the construction of sewerage systems, sewage treatment plants, treatment of animal waste, installation of septic tanks for houses not connected to the sewerage system, appropriate solid waste disposal, and periodic cleaning of the reservoir.

32. The responsibility for construction and operation of new sanitation and sewerage facilities, as well as upgrading existing facilities, was allocated to the respective guns (districts within the province). The financing of the program is mainly from the central government (70%), with the balance being split evenly between the province and the guns. The total investment is estimated at W 176.4 billion, and is being implemented in two phases. The first phase (W 104.6 billion) started in 1992 and is scheduled to be completed in 1996. The second phase ( W 71 7 billion) is expected

to start in 1997 and be completed by 2001. The program and the work completed to date was satisfactory.

33. The alignment of the raw water transmission main was changed to reduce the number of houses to be relocated at the pumping station site during the project. The relocation and compensation arrangements in Korea are regulated by law, and are satisfactory. During appraisal of the project, it was expected that 14 houses would have to be relocated, but the amended design reduced this number to two. However, in preparation for the JRWSS second stage, an additional 14 houses had to be demolished and the families relocated. The relocation of all sixteen households has taken place; two locally, and the remainder have moved out of the area. All sixteen have received acceptable compensation settlements which conform to regulations, and there are no outstanding disputes.

## D. Major Factors Affecting the Project

34. The main reason for the two year delay in project completion was that the MOCT's annual budget allocation for the project was lower than planned due to reduced distribution from the national budget. The priority level of investments within the country is under constant review, and the allocation of funds for the Juam project was spread over a longer period than was projected at the time of appraisal. Additional delay was caused by leakage in the tunnels constructed as part of the project (para. 9).

35. In October 1993, an amount of US$ 1.7 million was canceled from the IBRD loan due to savings made on equipment and materials. The borrower requested an additional one year extension to the loan, but this was not approved as the rate of return financial covenant had not been kept (para. 16). The loan was closed on December 31, 1994 in accordance with the initial plan, and the final disbursement took place on August 2, 1995, at which time a balance of US$ 4.3 million was canceled.

36. Leaks were experienced at the exit of each tunnel's connection with the steel pipeline. Corrective action and repairs commenced on October 12, 1995 and were completed by the end of December, 1995.

37. A modification to the project was the extension of water supply to the port town of Mokpo from the Kwangju raw water pipeline. Construction started in May 1993 and was completed in December 1995 (para. 6).

38. The standard of performance of the contractors for civil works, electrical and mechanical work on the pumping station and treatment plant, transmission main and tunnels, was generally good. Performance on equipment supply contracts was satisfactory; deliveries were not held up, and all equipment supplied conformed to specification.

39. The clear sector policies and guidelines, as well as government commitment to the project, were major factors in the positive, albeit delayed, results of the project. Administrative procedures, and staffing and management effectiveness were satisfactory.

## E. Project Sustainability

40. The project's achievements are expected to be fully sustainable. The completed project will be operated and maintained by KOWACO, which is an efficiently managed public enterprise. Its financial management systems and management information system were strengthened, partly as a result of the study undertaken under the Metropolitan Region Water Supply Project (Ln. 2350-KO) in 1987, and the accuracy of its financial reporting and detailed projections aided management in carrying out its responsibilities.

41. The complementary works will be operated and maintained by KWA, which is a semi-autonomous agency within the city, and by the neighboring municipalities. KWA is efficiently run and has successfully reduced non-revenue water from 55.5% to 31.0% over a 10 year period. At the same time, the number of connections has increased by 33%. KWA's competence to sustain the benefits of the project is fully expected. The municipalities staff is satisfactorily trained in the MOCT national training facility and adequately supervised by the province.

42. One problem which could threaten sustainability is failure to set tariffs at levels which would allow KOWACO and KWA to operate as self-financing public enterprises, where user charges reflect the level of services provided. Both KOWACO' s Water and Dams Divisions and KWA did not reach their rate of return targets due mainly to their failure to increase tariffs (para. 16). Since 1993, Kwangju City government has had greater freedom to raise tariffs, and this authority was used to increase tariffs in July 1994, and again from January 1, 1996. While KOWACO does not enjoy the same powers, tariffs in both divisions were increased by around 15% in August 1995.

43. The project's positive environmental objective to provide reliable, adequate, and safe water supplies to KMA and neighboring municipalities has contributed to the improvement of the health and living standards of the local population and is wholly sustainable (paras. 24-27)

## F. Bank Performance

44. The project was consistent with government's and Bank's development and country strategy. The Bank was significantly involved during project preparation which resulted in changes of design and considerable reduction in the cost of the raw water pipelines and easier maintenance and staging of the project.

45. The technical alternatives selected for the project were appropriate, and represented the least-cost solution for the water requirements of Kwangju City and the neighboring municipalities. The Juam Dam is the only major source of water available in the region, and detailed analyses were carried out to select the best routing and sizing for the pipelines and tunnels.

46. There were no unusual project risks. The major risk was that the envisaged industrial and social development in the region would not evolve as projected, and consequently the demand for water would be greater or smaller than planned. The development within the area has progressed at a slower rate than expected during appraisal (e.g. Kwangju City population in 1994 was at the level projected for 1991), but the two year delay in project completion has partly balanced this position.

47. Continuity of Bank staff during implementation was highly satisfactory with only one position changing between the appraisal through to the end of supervision. The continuity was especially important as some of the key staff of the implementing and operating agencies changed during implementation. The seven supervision missions were carried out at regular intervals during implementation.

48. The only significant issue between the Bank and the government was the matter of tariff policies, which led to the failure of KOWACO and KWA to achieve their rate of return targets as required in Section 4.04 of the KOWACO Agreement, and Section 4.05 of the Kwangju Agreement. Details of the required and actual rate of return figures are shown in Table 2 para. 16. The breach of the covenant and failure to provide an acceptable action plan to correct the situation led to the non-approval of the last requested extension of the loan.

## G. Borrower Performance

49. The project completion was delayed by two years mainly due to inadequate budget allocation to the project. This failure to commit the agreed funds on a timely basis was beyond the control of KOWACO. Apart from this aspect, and the failure to comply with the rate of return covenant, the performance of all involved agencies was satisfactory, particularly considering the cooperation that was needed between the various organizations and the changes in management.

50. The project's positive environmental impact reflects the cooperation of the Korean authorities, particularly KOWACO and MOCT which also showed responsiveness to the Bank's suggestions on project design and implementation.

51. The format and content of records and reports on physical progress and costs, established at the beginning of the project in collaboration with the implementing and operating agencies, the consultants, and the Bank, proved to be very successful.

52. Performance did not meet expectations in the failure of KOWACO Water and Dams Divisions and KWA to reach their forecasted revenue projections and rate of return targets (para. 16). Although revenues were less than expected during appraisal, there was no reduction in operational and maintenance expenditure on the facilities (para. 15).

53. KWA's submission of operational and financial monitoring indicators, computerized planning and financial forecasting, and a redesigned management information system was not as agreed during negotiations, leaving Bank supervision missions to gather the data and information, and report the findings (para 22 ).

54. The performance of KWA in reducing NRW is highly satisfactory. The introduction of the NRW program resulted from the Bank financed Second Water Supply Project (Nakdong Barrage) Loan 2350-KO which transferred technology in leak detection to more than 20 water agencies in Korea. NRW in the KWA system was at the unacceptably high figure of 48% at the time of appraisal, but the program of leak detection and rehabilitation of old pipelines successfully reduced this figure to 31% in 1995. This program is on-going with the aim to reach 20% of production by 2001.

55. The status of performance on the major covenants in the loan and project agreements is shown in Table 10 of Part II of this report.

## H. Assessment of Outcome

56. The project outcome overall is satisfactory. The project's main objectives have been met, albeit with a delay in the completion of construction of two years, and the port town of Mokpo has been added to the municipalities in the region benefiting from the new water supply. Improvements to institutions have been supported, with the NRW reduction program in KWA, and the improved planning and submission process for tariff reviews.

57. KMA and the neighboring municipalities experienced many years of water shortages, which restricted industrial growth and reduced the ability to substantially increase the number of house connections and supply a greater proportion of the population, especially in the low-income areas. Since July 1994, the new supply to Kwangju from JRWSS has ended the restrictions in KMA, and supplies have increased to the neighboring municipalities including Mokpo since the end of 1995.

58. The facilities completed under the project are clearly sustainable. KOWACO, KWA and the other municipalities are capable of planning, constructing, operating and maintaining their facilities.

59. Environmental issues are addressed with the Juam Dam Water Pollution Program to protect and improve the quality of water in the reservoir, which provides reliable and safe water supplies (para 25). The residents in the region are very conscious of the environment, and the on-going increased sewerage and sanitation facilities in KMA and the other municipalities will help to improve their community.

## I. Future Operation

60. The completed project works will be operated and maintained by KOWACO and the complementary works by KWA and the municipalities. The JRWSS second stage is already under construction and will provide additional water to the region by 1998.

61. KOWACO is a highly experienced public enterprise in construction, operation and maintenance of multi-purpose dams and water supply facilities, and currently operates about half the water systems in Korea. It has a well developed management information system and regularly monitors its physical and financial performance to ensure effective operation of all the facilities under its control. It has its own training school and supports various education programs for its staff. The future operating plan for the project will continue to upgrade the organization's capacity to properly operate and maintain the system and maximize the project benefits.

62. KWA is experienced in satisfactorily operating its original water treatment plant similar to the one constructed as part of the complementary works. The existing allocation of duties and responsibilities is satisfactory, and the institutional developments are keeping pace with the growth of the organization. Regular monitoring of performance is recorded for management including financial results, operating efficiency of the treatment plants, reduction in NRW, as well as other management related matters.

## J. Key Lessons Learned

63. The accident that caused leaks in four of the nine tunnels built under the project was caused by operational inexperience. The implementing agencies should ensure that specialists are employed to supervise construction where new technology is introduced, and to provide manuals and training to the staff of the operating agencies.

64. The data for all the operational and financial projections were provided by KOWACO and KWA, and the former successfully continued to update these projections. During appraisal it was recognized that KWA did not have the in-house capability to produce these reports, so members of the finance staff received training, but KWA still did not produce these reports as expected. The original reporting structure for KWA was changed and simplified to the Bank's satisfaction. Coordination with the sector ministry may help to ensure continuity of the acquired skills during officers' rotation.

65. The importance of setting tariffs to generate adequate levels of income has become more significant to the borrower and operating agencies, especially from 1996, as KOWACO has to contribute around 30% to all new capital projects, which in previous years have been financed by the central government.

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Table 1: Summary of Assessments

| Achievement of Objectives | Substantial | Partial | Negligible | Not Applicable |
|---|---|---|---|---|
| Macroeconomic policies | | | | X |
| Sector policies | | X | | |
| Financial objectives | | X | | |
| Institutional development | | X | | |
| Physical objectives | X | | | |
| Poverty reduction | | | | X |
| Gender concerns | | | | X |
| Environmental objectives | | X | | |
| Public sector development | | X | | |
| Private sector development | | | | X |

| Project Sustainability | Likely | Unlikely | Uncertain |
|---|---|---|---|
| | X | | |

| Bank Performance | Highly Satisfactory | Satisfactory | Deficient |
|---|---|---|---|
| Identification | X | | |
| Preparation assistance | X | | |
| Appraisal | X | | |
| Supervision | X | | |

| Borrower Performance | | | |
|---|---|---|---|
| Preparation | X | | |
| Implementation | | X | |
| Covenant compliance | | | X |

| Assessment of Outcome | Highly Satisfactory | Satisfactory | Un-satisfactory | Highly Un-satisfactory |
|---|---|---|---|---|
| | | X | | |

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Table 2: Related Bank Loans

| Loan Title | Purpose | Approved | Status |
|---|---|---|---|
| Preceding operations | | | |
| First Water Supply Project (Ln 2072-KO) | Expanded water services in five cities | 1982 | Complete. loan closed 06/30/87 PPAR No. 8174, 1989 |
| Second Water Supply Project (Nakdong Barrage Ln 2350-KO) | Eliminated sea water intrusion in Nakdong delta | 1984 | Complete. loan closed 06/30/89 PCR No. 8675,1990 |
| Third Water Supply Project (Metro Region Ln 2491-KO) | Water supply to 25 municipalities in Seoul Metro region | 1985 | Complete. loan closed 12/31/90 PCR No. 11530 |
| Fourth Water Supply Project (Namgang & Taegu Ln 2615-KO) | Expanded water services in 14 municipalities | 1986 | Complete. loan closed 06/30/90 PCR No. 10833 |
| Pusan and Taejon Sewerage Project Ln 3450-KO) | Expanded waste-water treatment cap. & reduced pollution in rivers & coastal waters. | 1992 | Complete. loan closed 06/30/96 est. ICR under pre-paration |
| Following operations | | | |
| Kwangju & Seoul Sewerage project Ln 3590-KO | Expand wastewater treatment capacity & reduce pollution in the city rivers | 1993 | On-going. Project completion planned 12/31/96 |
| Waste Disposal Project Ln 3830-KO | Expand wastewater treatment capacity in Pusan, and provide specified waste incinerator in Kunsan | 1994 | On-going. Project completion planned 06/30/99 |

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Table 3: Project Timetable

| Steps in project cycle | Date planned | Date actual |
|---|---|---|
| Identification | - | 10/27/88 |
| Preparation | - | 02-06/89 |
| Appraisal | - | 09/89 |
| Negotiations | 12/89 | 01/10/90 |
| Board presentation | 04/90 | 03/20/90 |
| Signing | 04/90 | 08/10/90 |
| Effectiveness | 05/90 | 12/04/90 |
| Project completion | 12/31/93 | 12/31/95 |
| Loan closing | 12/31/94 | 12/31/94 |

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Table 4: Loan Disbursements: Cumulative Estimated and Actual

(US$ Millions)

| | FY90 | FY91 | FY92 | FY93 | FY94 | FY95 | FY96 |
|---|---|---|---|---|---|---|---|
| Appraisal estimate | 3.7 | 5.8 | 12.6 | 24.3 | 32.3 | 34.0 | 34.0 |
| Actual | 0 | 0 | 3.0 | 16.2 | 24.4 | 25.8 | 28.0 |
| Actual as % of estimate | - | - | 23.8% | 66.6% | 75.5% | 75.9% | 82.4% |

Date of final disbursement - 08/02/95

Note: Delay in effectiveness and start of the project had a negative impact on disbursements.

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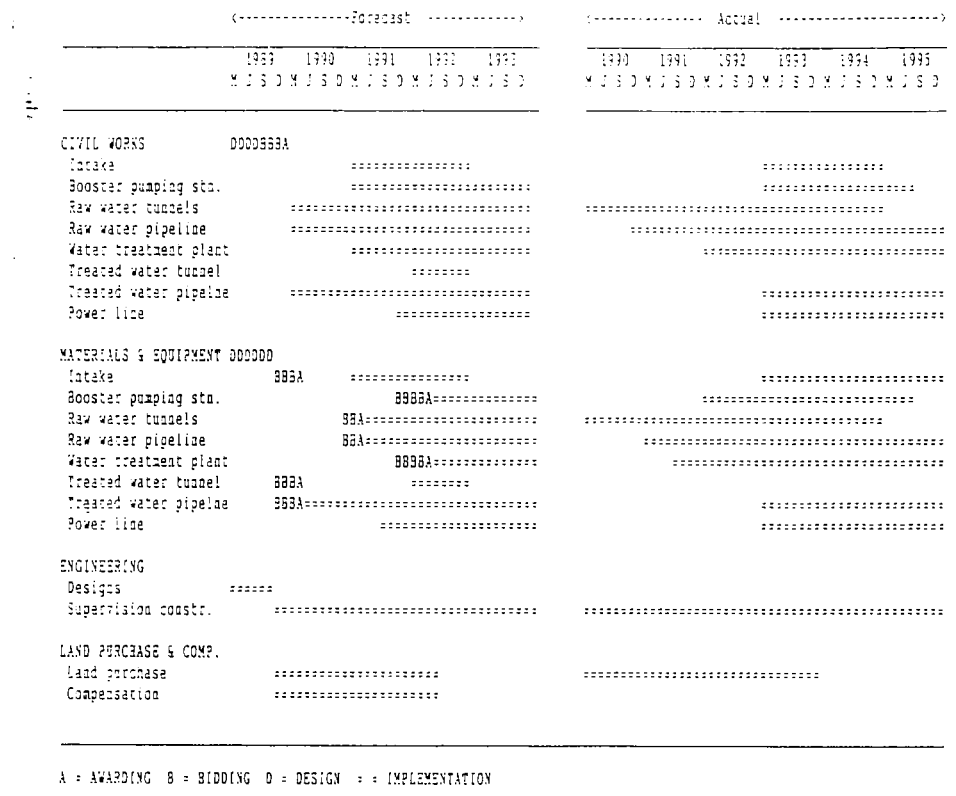
Implementation Completion Report
Juam Regional Water Supply Project (Loan 1178-KO

Table 5: Key Indicators for project implementation

Implementation Schedule




A = AWARDING B = BIDDING D = DESIGN = = IMPLEMENTATION

Annex
Implementation Completion Report
Daegu Regional Water Supply Project (Loan 2173-KO)

Table 6: Key indicators for project operation

Monitoring Indicators - KOWACO's Water Division

| | <---------- Forecast ----------> | | | | <---------- Actual ----------> | | | |
|---|---|---|---|---|---|---|---|---|
| Year ended December 31 | 1991 | 1992 | 1993 | 1994 | 1991 | 1992 | 1993 | 1994 |
| Raw water sold m3 million | 1605 | 1722 | 1774 | 2142 | 1581 | 1612 | 1676 | 1787 |
| Treated water sold m3 million | 396 | 521 | 582 | 621 | 444 | 517 | 650 | 753 |
| MANAGEMENT | | | | | | | | |
| Days accounts receivable No. | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Employees No. | 1251 | 1311 | 1446 | 1443 | 1237 | 1301 | 1445 | 1435 |
| FINANCIAL RATIOS | | | | | | | | |
| Ave.raw water tariff Won/m3 | 48.0 | 48.5 | 49.9 | 53.4 | 45.4 | 47.4 | 48.0 | 47.9 |
| Ave.treated water tariff Won/m3 | 104.0 | 106.1 | 109.2 | 116.9 | 92.9 | 91.8 | 90.4 | 90.2 |
| Working ratio | 69.3% | 66.3% | 66.7% | 65.4% | 93.3% | 94.4% | 93.0% | 94.1% |
| Rate of return | 3.5% | 5.0% | 5.0% | 5.0% | 2.6% | 2.4% | 2.6% | 2.1% |
| Debt service ratio | 2.0 | 2.6 | 3.3 | 4.0 | 6.5 | 7.3 | 8.7 | 9.9 |

Monitoring Indicators - KOWACO's Dams Division

| | <---------- Forecast ----------> | | | | <---------- Actual ----------> | | | |
|---|---|---|---|---|---|---|---|---|
| Year ended December 31 | 1991 | 1992 | 1993 | 1994 | 1991 | 1992 | 1993 | 1994 |
| Water rights m3 million | 2585 | 2955 | 3242 | 3254 | 2884 | 3273 | 3527 | 3904 |
| Power sales - GWH | 1946 | 2013 | 2115 | 2115 | 1788 | 1381 | 2033 | 1125 |
| MANAGEMENT | | | | | | | | |
| Days accounts receivable No. | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 |
| Employees No. | 550 | 650 | 660 | 680 | 545 | 625 | 657 | 657 |
| FINANCIAL RATIOS | | | | | | | | |
| Average rates: | | | | | | | | |
| Mun.& Ind.Water rights Won/m3 | 6.32 | 6.72 | 6.93 | 7.61 | 5.94 | 7.13 | 7.13 | 7.13 |
| Power Won/KWH | 43.66 | 47.65 | 49.55 | 54.81 | 43.42 | 44.53 | 45.93 | 46.82 |
| Working ratio | 26.0% | 30.4% | 33.3% | 37.2% | 29.8% | 42.2% | 35.0% | 49.3% |
| Rate of return | 5.0% | 5.0% | 5.0% | 5.0% | 5.0% | 2.0% | 6.1% | 3.3% |
| Debt service ratio | 1.9 | 1.2 | 1.1 | 1.1 | 1.5 | 0.8 | 1.1 | 1.2 |

Korea
Implementation Completion Report
Juan Regional Water Supply Project (Loan 3173-KO)

Table 5: Key indicators for project operation

Monitoring Indicators - Kwangju Water Agency

| | Forecast | | | | Actual | | | |
|---|---|---|---|---|---|---|---|---|
| Year ended December 31 | 1991 | 1992 | 1993 | 1994 | 1991 | 1992 | 1993 | 1994 |
| PHYSICAL PARAMETERS | | | | | | | | |
| % Population w/water connections | 90.0% | 91.0% | 92.0% | 94.0% | 90.0% | 91.0% | 91.5% | 92.9% |
| Water connections 000s | 99.2 | 103.3 | 107.7 | 112.1 | 93.9 | 94.7 | 96.4 | 99.3 |
| Liters sold lcd | 172 | 168 | 192 | 201 | 172 | 194 | 185 | 212 |
| Liters produced lcd | 292 | 280 | 311 | 317 | 292 | 312 | 274 | 312 |
| Water production m3 million | 125 | 125 | 145 | 155 | 125 | 127 | 117 | 137 |
| MANAGEMENT | | | | | | | | |
| Days accounts receivable No. | 11 | 11 | 11 | 11 | 6 | 5 | 5 | 5 |
| Employees No. | 390 | 447 | 457 | 466 | 447 | 486 | 492 | 643 |
| Employees/1000 connections | 3.9 | 4.3 | 4.2 | 4.2 | 4.8 | 5.1 | 5.1 | 6.5 |
| Non-revenue water | 43.0% | 41.3% | 39.6% | 38.0% | 39.8% | 37.3% | 32.4% | 32.1% |
| FINANCIAL PARAMETERS | | | | | | | | |
| Ave. water tariff Won/m3 | 288 | 294 | 301 | 309 | 286 | 286 | 309 | 324 |
| Working ratio | 46.1% | 49.3% | 48.8% | 49.1% | 46.1% | 54.8% | 57.2% | 51.8% |
| Rate of return | 10.6% | 9.1% | 9.0% | 9.0% | 6.6% | 8.5% | 7.1% | 7.5% |
| Contribution to investment | 15.1% | 2.2% | 12.5% | 9.8% | 9.9% | 5.5% | -3.5% | 4.2% |
| Debt service ratio | 1.1 | 1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.9 | 1 |
| Debt/equity ratio | 149.0% | 135.5% | 117.0% | 100.8% | 148.2% | 169.2% | 140.1% | 120.2% |

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Table 7: Studies included in project

| Study | Purpose as defined at appraisal | Status | Impact of study |
|---|---|---|---|

There were no studies associated with this project

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Table 8A: Project costs

(US$ million)

| Item | Appraisal estimate Local | Foreign | Total | Actual cost Local | Foreign | Total |
|---|---|---|---|---|---|---|
| Civil works | 88.1 | 22.0 | 110.1 | 75.5 | 15.4 | 90.9 |
| Intake | 0.6 | 0.1 | 0.7 | 0.5 | 0.9 | 1.4 |
| Booster pumping stn. | 2.7 | 0.6 | 3.3 | 0.3 | 0.6 | 0.9 |
| Raw water tunnel | 51.8 | 13.0 | 64.8 | 37.1 | 8.1 | 45.2 |
| Raw water pipeline | 16.3 | 4.1 | 20.4 | 25.1 | 4.0 | 29.1 |
| Water treatment plant | 10.2 | 2.5 | 12.7 | 7.9 | 1.0 | 8.9 |
| Treated water tunnel | 1.3 | 0.4 | 1.7 | | | |
| Treated water pipeline | 4.5 | 1.1 | 5.6 | 3.7 | 0.5 | 4.2 |
| Power line | 0.7 | 0.2 | 0.9 | 0.9 | 0.3 | 1.2 |
| Materials & equipment | 18.4 | 39.9 | 58.3 | 10.1 | 20.3 | 30.4 |
| Engineering | 4.4 | - | 4.4 | 14.3 | - | 14.3 |
| Design | 1.6 | - | 1.6 | | | |
| Supervision | 2.8 | - | 2.8 | | | |
| Land acquisition | 5.8 | - | 5.8 | 8.4 | - | 8.4 |
| Purchase | 3.7 | - | 3.7 | | | |
| Compensation | 2.1 | - | 2.1 | | | |
| Sub total | 116.7 | 61.9 | 178.6 | 108.3 | 35.7 | 144.0 |
| Mokpo extension | | | | | | |
| Civil works & equipment | | | - | | | 56.5 |
| Land acquisition | | | - | | | 3.2 |
| Other costs | | | - | | | 1.6 |
| I.D.C. | 2.8 | 1.6 | 4.4 | 4.0 | 2.3 | 6.3 |
| Total | 119.5 | 63.5 | 183.0 | 112.3 | 38.0 | 211.6 |

Table 8B: Project financing

| Source | Appraisal estimate Won billion | US$ million | Actual Won billion | US$ million |
|---|---|---|---|---|
| IBRD Loan | 22.4 | 34.0 | 22.2 | 28.0 |
| Government Contributions | 98.4 | 149.0 | 137.8 | 183.6 |
| Total | 120.8 | 183.0 | 160.0 | 211.6 |

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Table 9: Economic rate of return
(Billion Won)

| Year | <------OUTFLOWS--------> | | | <-------INFLOWS--------> | | | |
|---|---|---|---|---|---|---|---|
| | | <----O&M----> | | Water <--Revenues--> | | Other | NET |
| | Total Investmnt | KWA | Others | KWA | Others | Revenues | FLOW |
| 1989 | 6.20 | | | | | | -6.2 |
| 1990 | 7.94 | | | | | | -7.94 |
| 1991 | 12.09 | | | | | | -12.09 |
| 1992 | 13.50 | | | | | | -13.5 |
| 1993 | 36.52 | | | | | | -36.52 |
| 1994 | 64.31 | 1.63 | | 4.47 | | 0.92 | -60.55 |
| 1995 | 19.41 | 4.13 | 0.94 | 14.29 | 0.34 | 0.94 | -8.91 |
| 1996 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.75 | 12.93 |
| 1997 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 1998 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 1999 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2000 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2001 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2002 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2003 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2004 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2005 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2006 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2007 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2008 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2009 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2010 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2011 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2012 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2013 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2014 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2015 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2016 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2017 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2018 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2019 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2020 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2021 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2022 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2023 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2024 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2025 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2026 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2027 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| 2028 | | 4.13 | 0.94 | 14.29 | 2.96 | 0.97 | 13.15 |
| | | | | FINANCIAL RATE OF RETURN = | | | 7.0% |

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Juam Regional Water Supply Project (Loan 3178-KO)

Table 10: Status of legal covenants

| Agreement | Covenant | Present type | Description of covenant | Status | Comments |
|---|---|---|---|---|---|
| KOWACO | | | | | |
| 2.02 | 10 | C | KOWACO to enter into a Transfer & Operation Agreement | | Agreement to be made May 1996 |
| 4.02 | 1 | C | KOWACO to submit audited accounts | | Complied |
| 4.04 | 2 | NC | Dams & Water divs.to achieve 5% ROR | | ROR achieved<br>Water / Dams<br>1992 2.4% 2.0%<br>1993 2.6% 6.1%<br>1994 2.1% 3.3%<br>est.1995 2.2% 3.5% |
| KWANGJU | | | | | |
| 4.01 | 10 | C | KWA to rehabilitate system and continue leak detection. | | Complied |
| 4.02 | 5,2 | C | KWA to implement computerized financial forecasting | | After modification Complied. |
| 4.03 | 5 | CP | KWA to implement MIS | | Partial compliance |
| 4.05 | 2 | NC | KWA achieve ROR of at least 9% | | ROR achieved<br>1992 8.5%<br>1993 7.1%<br>1994 7.5%<br>est.1995 8.0% |
| LOAN AGREEMENT | | | | | |
| 3.03 | 10 | C | Borrower to cause municipalities complete their system extensions. | | Complied |
| 4.1(b) | 1 | C | Six months after end of each year borrower will submit audited accounts of the project. | | Complied |

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Juam Regional Water Supply Project (Loan 3178-KO)

Table 11: Bank resources: staff inputs

| Stage of project cycle | Actual | |
|---|---|---|
| | weeks | US$'000 |
| Through appraisal | 29.3 | 65.3 |
| Board approval | 9.1 | 19.0 |
| Supervision | 42.6 | 97.6 |
| Completion (est) | 9.7 | 6.8 |
| TOTAL | 90.7 | 188.7 |

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Table 12: Bank resources: Missions

| Stage of project cycle | month/ year | No.of persons | days in field | Specialized staff skills represented | Performance rating. Development impact. | Types of problems |
|---|---|---|---|---|---|---|
| Through appraisal | 01/89 to 09/89 | 2 | 29 | Fin.Analyst<br>Sanitary Eng. | - | - |
| Appraisal, Board approval | 03/90 | | 9 | Project,loan and legal officers<br>Sanitary Eng. | - | - |
| Super-vision 1. | 04/90 | 2 | 10 | Fin.Analyst<br>Sanitary Eng. | 1 | Tariff increases required. |
| " 2. | 10/90 | 3 | 3 | Fin.Analyst<br>Sanitary Eng. | 1 | Kwangju leg.opinion.<br>ROR targets not met. |
| " 3. | 07/91 | 2 | 2 | Fin.Analyst<br>Sanitary Eng. | 1 | Project delay/fund'g.<br>ROR targets not met.<br>Audit delay. |
| " 4. | 05/92 | 2 | 6 | Sanitary Eng.<br>Fin.Analyst | 1 | Mokpo ext.proposed.<br>reservoir water qual.<br>poor. MIS re-design. |
| " 5. | 06/93 | 2 | 2 | Sanitary Eng.<br>Fin. Analyst | 1 | Kwangju water shortge<br>ROR targets not met.<br>KOWACO staff cost high |
| " 6. | 03/94 | 2 | 4 | Sanitary Eng.<br>Fin.Analyst | 1 | Project delay 10/95<br>ROR targets not met. |
| " 7. | 10/94 | 2 | 3 | Sanitary Eng.<br>Fin.Analyst | 1 | Juam 2nd phase dev.<br>ROR targets not met. |
| Comple-tion | 11/95 | 1 | 7 | Fin.Analyst | | |

# Report on Project Estimation

Ju-am Regional Bulk Water Supply System

Nov. '95

☐ Purpose

The purpose of this project is to meet the increasing water demand in Kwang-ju city and other areas in the vicinity in which water resources are not sufficient due to geographical condition.

☐ Summury

- o Intake source : from Ju-am Dam
- o Capacity : 420,000ton/day
- o Target year : Kwang-ju '96, Mok-po 2005, other areas 2001
- o Period : '89-'95
- o Content : 1 Booster Pump Station,
  1 Water Treatment Facility1,
  100.6㎞ Pipe Line
  9 Tunnels (14.8㎞ )
- o Supply Area : Kwang-ju city,Na-ju city, Mok-po city, Hwa-soon
- o Total Expense : 159 Billion-won

☐ History

- o Sep. '87 - Jun. '88 : Feasibility Study & Conceptual Design
- o Sep. '88 - Aug. '89 : Detailed Design
- o Dec. 29. '89 : Start of Construction
- o Oct. '93 : Start of Mok-po Line
- o Jul. 1. '94 : Start of Water Supply Service to Kwang-ju
- o Dec. 31. '95 : Completion as Scheduled

☐ Annual Investment

(Korean unit : 100 Million won)

| 계 | '89 | '90 | '91 | '92 | '93 | '94 | '95 |
|---|---|---|---|---|---|---|---|
| 1,591 | 53 | 106 | 127 | 172 | 392 | 495 | 247 |

※ Loan Summary

- Source : IBRD (3178-KO)
- Amount : $ 34,000,000
- Agreement Date : Aug. 10. '90
- Terms : repayment in 10 years with 5 year graceperiod
- Repayment Period : Oct.1.'95 ~ Apr.1.2005
  (Date : Every Oct.1,Apr.1)
- Canceled('93.10. 6) : $ 5,987,610.38
- Withdrawn : $ 28,012,389.62

* Schedule for Repayment of Loan

- Out of the total amount $ 34,000,000, $ 1,700,000 (Oct.6.'93) and $ 4,287,610.38 (Aug.2.'95) was canceled.
  Schedule for repayment of withdrawal $ 28,012,389.62 has not been noticed from IBRD

☐ Main Items

- ○ Booster Pump Station : Q=520,000CMD
- ○ Water Treatment Facility : Q= 60,000CMD
- ○ Intake Pipe Line : D=2,800mm, L=770m
- ○ Tunnel(Water Conveyance)
  - · Jang-Dae : D=2,800, L=7,760m
  - · Eup-Ae : D=2,800, L=1,407m
  - · Mu-Po : D=2,800, L= 895m
  - · O-dong : D=2,800, L=1,655m
  - · Dong-lim : D=2,800, L= 780m
  - · Jang-dong : D=2,800, L= 795m
  - · Tam-jae : D=2,600, L= 145m
  - · Deok-nam : D=2,600, L= 865m
- ○ Pipe Line(Water Conveyance) : D=2,800~900mm, L= 21.3Km
- ○ Pipe Line(Water Transmission) : D=1,200~800mm, L= 25.1Km

※ Mok-po Line(included in '91)

- ○ Pipe Line(Water Conveyance) : D=1,200mm, L= 54.4Km
- ○ Pump Station : Q=120,000CMD

☐ Organizations involved

- ○ Conductor : Office of South-West Regional water Works, MOCT
- ○ Contractor : Dong-A Co.Ltd., Nam-Jin Co.Ltd.
- ○ Design : Sam-an Const. Eng. Co.
- ○ Supervision : Sam-an Const. Eng. Co.

☐ Effect

- The system will contribute to improvement of the national health and sanitation and balanced urban development by solving the water problem in Kwang-ju area which is suffering from water shortage

- In Target year, Water Supply Service Level will rise to 95% from 74%,and litters per Capita Day will reach 387 ℓ/day from 257 ℓ/day.

☐ General Evaluation

- While This project(started in '89.12 and will be finished in '95.12) being carried out,

  on July 1 '94, water supply service to Kwang-ju which was suffering from the water shortage due to Drought and water contamination in Young-san river began with 140,000ton/day.

  From Dec. 21 '94 till Mar. 7 '95, supply service amount increased to 300,000ton/day(partially through yong-hyun Water treatment facility)

  And from Jan. 4 '95 till Mar. 7 '95, water of 150,000ton/day was discharged to improve the water quality of Young-san river which was in bad condition in quality due to abnormal drought

By this way, Ju-am Dam regional bulk water supply system has done good even before the completion of the project and will greatly contribute to the improvement of living environment and regional development in Kwang-ju, Mok-po, Na-ju, Hwa-soon area

- But leakage accident occurred in 4 tunnels out of 9 tunnels during the repairment of the valve to the yong-hyun emergency line.

Precise Safety Assessment was conducted for the preparation of eternal reinforcement against leakage accident and the reinforcement construction is underway from Oct. 13 '95.
The accident is thought to come from the lack of the experiences and high technology on the design of tunnel under water pressure.

It resulted in loss of property, inconveniences of people, and delay of the completion of the project

It is derived that engineers or specialists from developed countries shall take part in the fulfilment of design and supervising of this kind of project and officials in charge acquire the developed knowledge through training etc.

And also education on technolology to the operating members is required.

- The accurate equipment such as water purification, chemicals projection, instrument and control etc. need be introduced from the developed countries because domestic manufacturers are usually managed in small scale and retarded in those particular field

- This project was supervised by the engineering group from the company who designed the whole system of this project but shortage of engineers and specialist in this field and unsettlement of the new system on supervision seems to have helped the occurence of this accident

Korea
Implementation Completion Report
Juam Regional Water Supply Project (Loan 3178-KO)

Summary of
JUAM REGIONAL WATER SUPPLY SYSTEM

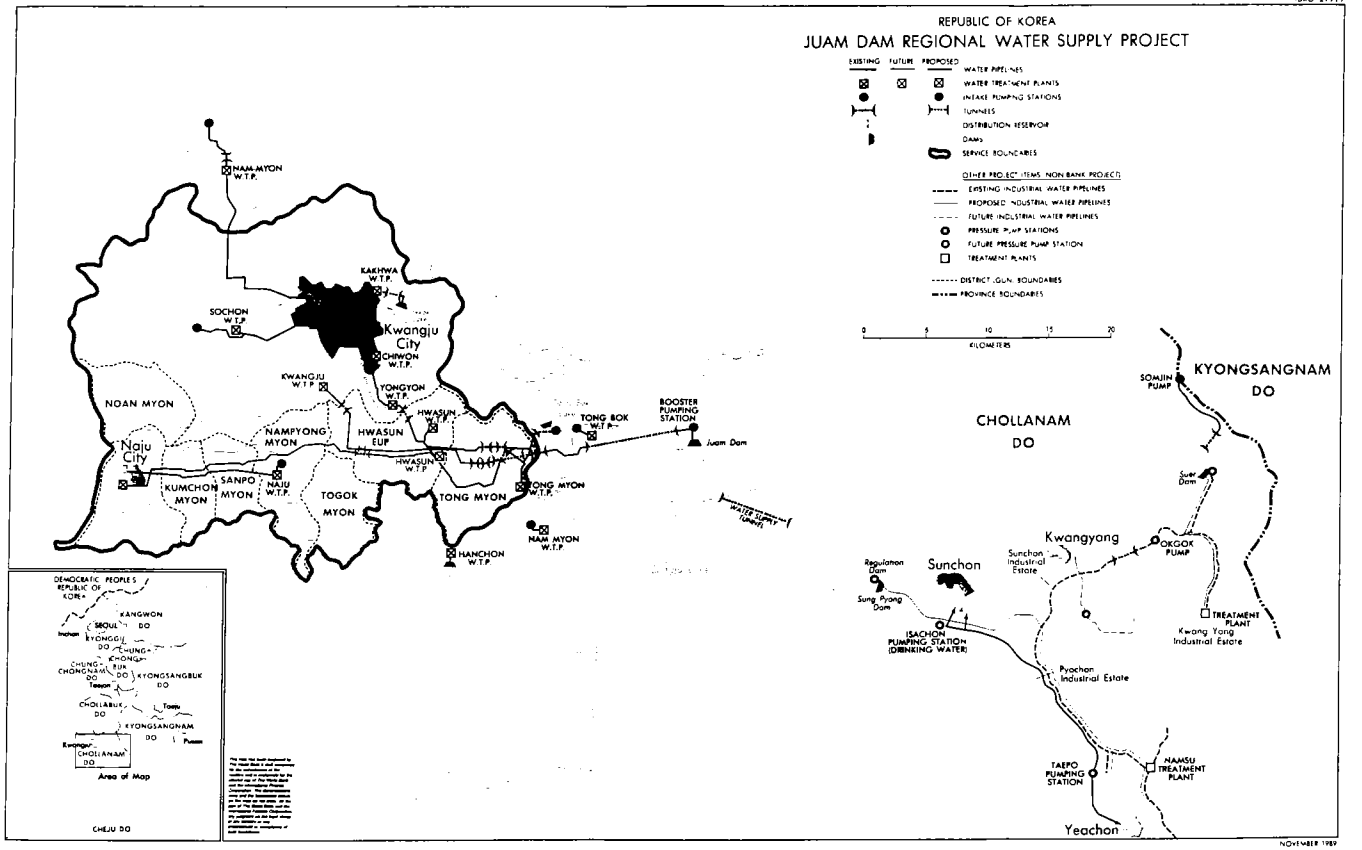
The Juam Regional Water Supply System (JRWSS) includes a multi-purpose dam at Juam completed in 1991, two raw water transmission mains, (one easterly to Suchon-Kwangyang industrial area, and one westerly to Kwangju Metropolitan Area - later extended to Mokpo), a number of water treatment plants, several treated water transmission mains and distribution networks. Environmental protection of the Juam reservoir against pollution, comprising of sewerage and wastewater treatment, disposal of municipal waste, control of fertilizer in agriculture, and other related measures, was added in a later stage.

The JRWSS is financed by the Government with some borrowing from the Bank, the Chollanam-do province and eight municipalities - networks in municipalities and environmental protection of Juam reservoir, and Kwangju city. For operational reasons some components are constructed for final capacity while the rest for the first stage only. Construction of the second stage commenced in 1995 and is scheduled to be completed in 1998.

Within the JRWSS, the Bank financed project included construction of the first stage of (a) westerly raw water transmission main and pumping station from the dam to Kwangju area, and (b) treatment plant and transmission main to distribute the treated water to the municipalities. The treatment plant in Kwangju city and the respective distribution network were financed by the city, and distribution networks and respective reservoirs in the municipalities were financed jointly by Chollanam-do province and the municipalities.

The multi-purpose dam, raw water transmission, municipalities treatment plant and treated water transmission mains are operated by KOWACO which charges Kwangju and Mokpo Water Agencies for bulk supply of raw water, and each of the eight municipalities for bulk supply of treated water. Kwangju city operates its own facilities, and the province assists the smaller municipalities, while the larger towns of Naju and Mokpo operate on their own.

IBRD 21919


REPUBLIC OF KOREA
JUAM DAM REGIONAL WATER SUPPLY PROJECT
EXISTING
FUTURE
PROPOSED
WATER PIPELINES
WATER TREATMENT PLANTS
INTAKE PUMPING STATIONS
TUNNELS
DISTRICT (GUN) BOUNDARIES
PROVINCE BOUNDARIES
KILOMETERS
NAM-MYON W.T.P.
KAKHWA W.T.P.
SOCHON W.T.P.
Kwangju City
CHIWON W.T.P.
KWANGJU W.T.P.
YONGYON W.T.P.
HWASUN W.T.P.
NOAN MYON
Naju City
NAMPYONG MYON
HWASUN EUP
HWASUN W.T.P.
TONG BOK W.T.P.
BOOSTER PUMPING STATION
Juam Dam
KUMCHON MYON
SANPO MYON
NAJU W.T.P.
TOGOK MYON
TONG MYON
TONG MYON W.T.P.
HANCHON W.T.P.
NAM MYON W.T.P.
CHOLLANAM DO
KYONGSANGNAM DO
SOMJIN PUMP
Suer Dam
Kwangyang
OKGOK PUMP
Sunchon Industrial Estate
Regulation Dam
Sunchon
Sung Pyong Dam
ISACHON PUMPING STATION (DRINKING WATER)
TREATMENT PLANT
Kwang Yang Industrial Estate
Pyochon Industrial Estate
TAEPO PUMPING STATION
NAMSU TREATMENT PLANT
Yeachon
Area of Map
CHEJU DO
NOVEMBER 1989

IMAGING

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